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ISS Fluids and Combustion Facility (FCF)

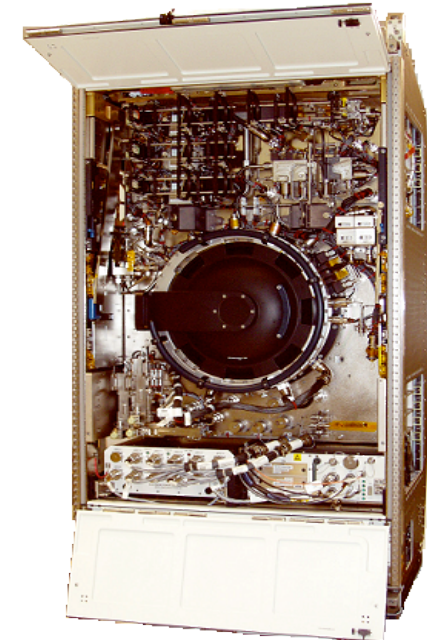
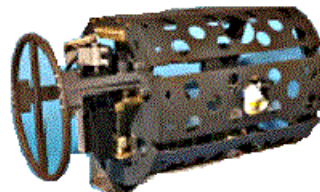
Payload Specific Hardware CIR First Increment

The Combustion Integrated Rack (CIR) includes support subsystems and combustion diagnostics commonly needed for combustion investigations and supplements the laboratory with unique science hardware developed for each Principal Investigator (PI).

Payload specific and multi-user hardware customizes the CIR in a unique laboratory configuration to perform research effectively.



Multi-User Droplet Combustion Apparatus (MDCA)



Payload Specific Hardware

- Unique hardware components
- Specific Diagnostics
- Unique PI fuels

Multi-Use Payload Apparatus

- Platform for droplet:
 - Dispensing
 - deploying
 - Ignition
- Infrastructure that uniquely meets the needs of PI experiments
- Unique science requirements

FCF Combustion Integrated Rack

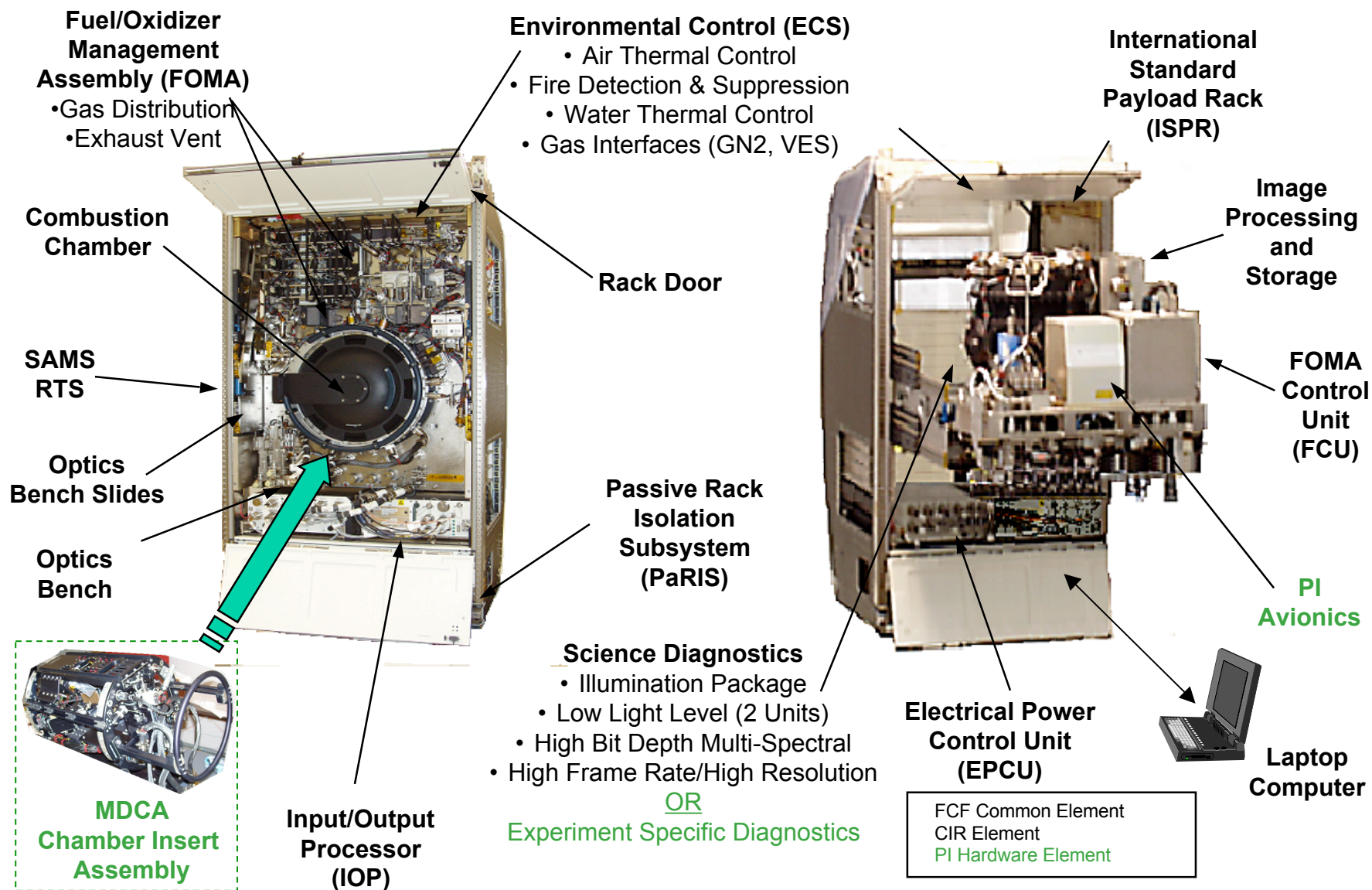
- Power Supply
- Avionics/Control
- Structural Support & Power
- Common Diagnostics and Illumination
- Environmental Control
- Data Processing/Distribution
- Fluids Control/Distribution
- Combustion Containment



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Combustion Integrated Rack (CIR) Overview



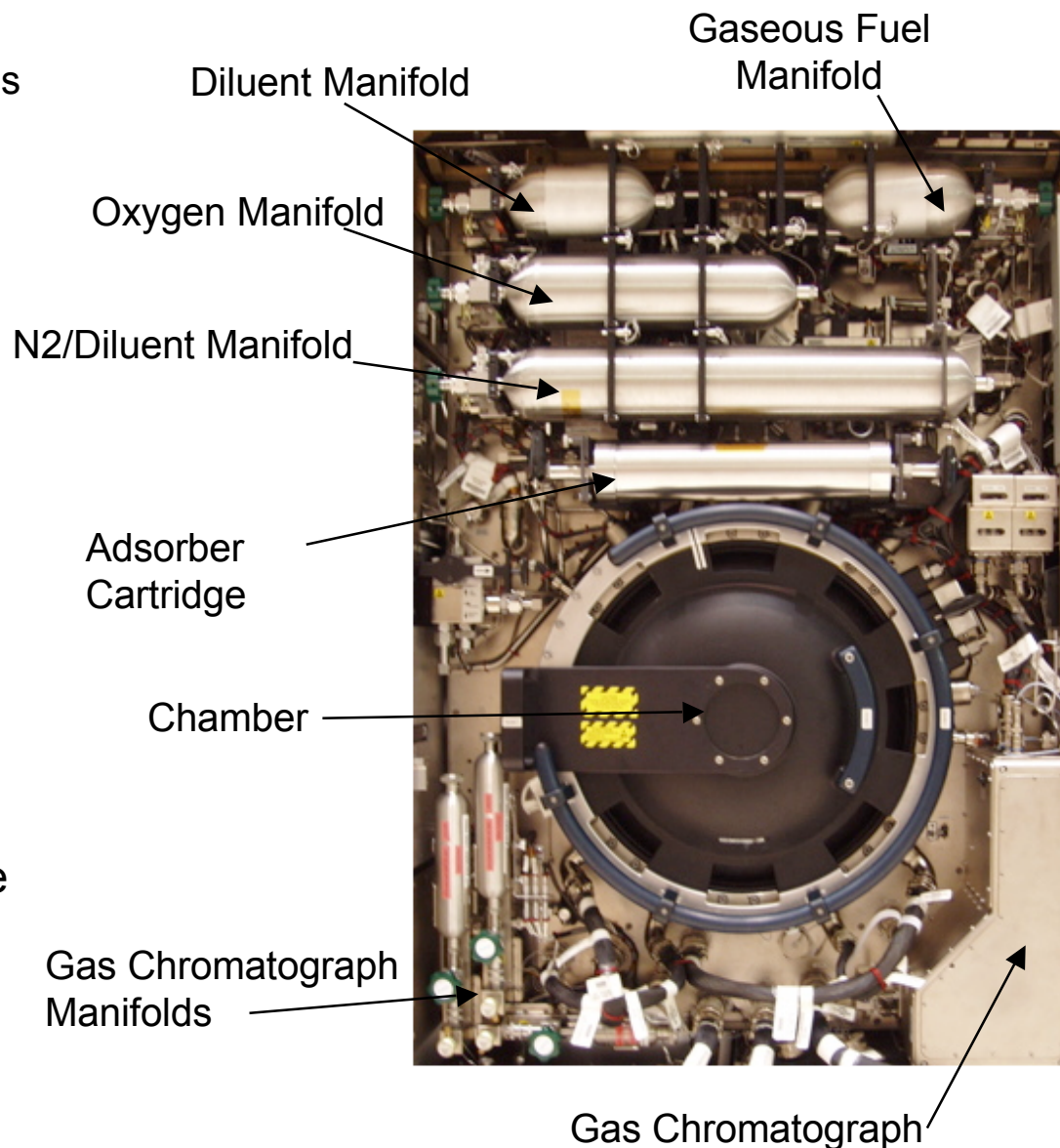


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CIR Fluid/Oxidizer Management Assembly

- Chamber
 - 100 Liters capacity
 - Operating pressure: 0.02 to 3 atmospheres and contains pressures up to 9 atmospheres
 - 8 Sapphire windows
- Supplies gaseous fuel, oxidizers and diluents to the combustion chamber
- Oxidizers Bottles:
 - 1.0 liter up to 80% O₂
 - 2.25 liter up to 50% O₂
 - 3.8 liter up to 30% O₂
- Quick disconnects used for easy attachment to manifolds
- Maximum oxidizer flow rates
 - 30 slm per manifold
 - 90 slm total
- Maximum fuel flow rate 2 slm
- Adsorber Cartridge removes unacceptable gases, including water vapor and particulates from the combustion event
- Provides the vent path to the ISS Vacuum Exhaust System
- 3 Column Gas Chromatograph





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FCF Avionics

- **Electrical Power Control Unit**

- ❖ Two 120 VDC, 50 Amp inputs on the rear of the EPCU
- ❖ Six 120 VDC, 4 Amp outputs on the rear of the EPCU
- ❖ Forty eight 28 VDC, 4 Amp output channels located in twelve connectors on the front of the EPCU (3KW total 28 Volt power)



- **Input/Output Processor (IOP)**

- ❖ Communication Interface between the rack and ISS.
 - ISS Low Rate Data Link, Medium Rate Data Link, High Rate Data Link & Video Interfaces
- ❖ Serves as the main controller and data acquisition system for the rack via internal rack ethernet
- ❖ Provides rack to rack interface to the FIR via fiber optic cable



- **Image Processing & Storage Unit (IPSU)**

- ❖ Stores digital image data received from a camera
- ❖ IEEE 1394 FireWire Interface for camera control and image acquisition
- ❖ Analog video (RS-170) input
- ❖ Analog video output from scan converter that converts digitally acquired data to an RS-170A signal
- ❖ Two 36 GB hard drives per IPSU



- **FOMA Control Unit (FCU)**

- ❖ Provides power conditioning & data control for all FOMA hardware
- ❖ Monitors all pressures, temperatures, and mass flow rates from the FOMA during gas blending and experiment operation
- ❖ Controls gas chromatograph for chamber sampling





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CIR Diagnostics

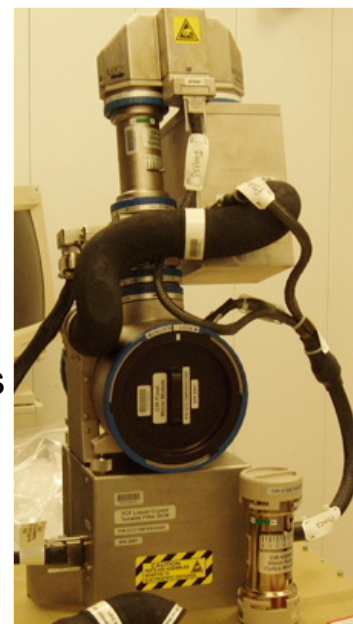


High Resolution/High Frame Rate Camera

- High Resolution Mode: 1024x1024 pixels at 7.5, 15, or 30 fps
- High Frame Rate Mode: 512x512 pixels at 60 or 110 fps
- Automated Tracking - 9 x9 mm Instantaneous FOV (IFOV)
- Focus over 30 mm object depth; 5mm/s focus speed
- Resolution is 20 lp/mm at 50% contrast in HR mode

High Bit Depth/Multi-Spectral Camera

- 1024x1024 pixels at programmed rates of 7.5, 15, or 30 fps
- 12 bit dynamic range
- Field of View: 50 mm square or 80 mm diameter
- Resolution: 10 lp/mm maximum (0.05 mm)
- Liquid Crystal Tunable Filter: 650-1050 nm spectral range



Low Light Level Packages (UV and IR)

- FOV: UV 42 or 100mm; IR 45mm
- 54 Frames per second
- UV package uses industry standard Gen II intensifier
- UV Spectral range: 220-850nm
- IR package uses industry standard Gen III intensifier
- IR spectral range: 400-900nm

Illumination Package

- 80mm diameter Collimated Beam
- Diffuse Laser Diode source
 - 10 mw coupled power
 - 655 nm peak wavelength

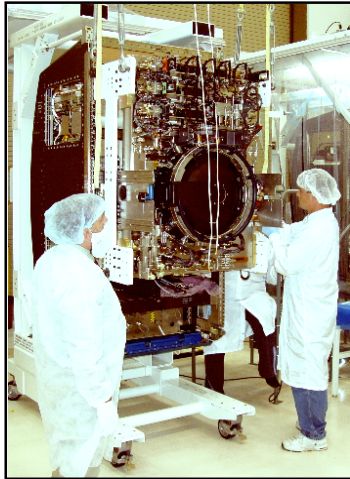




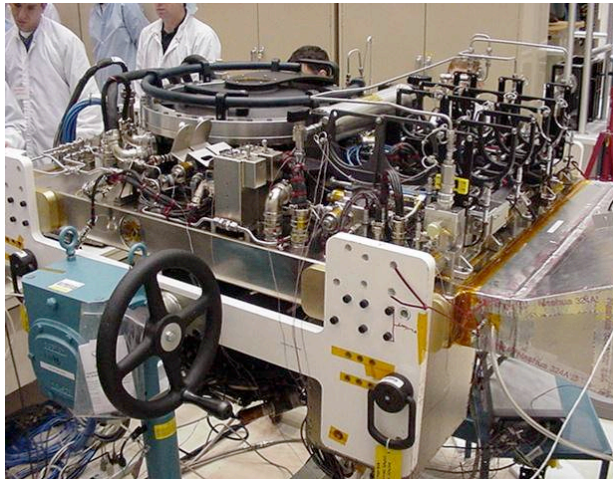
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The Combustion Integrated Rack Test Overview



HFIT



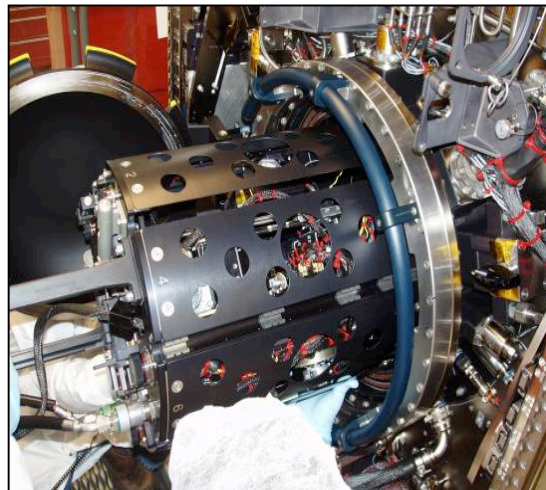
Thermal Testing



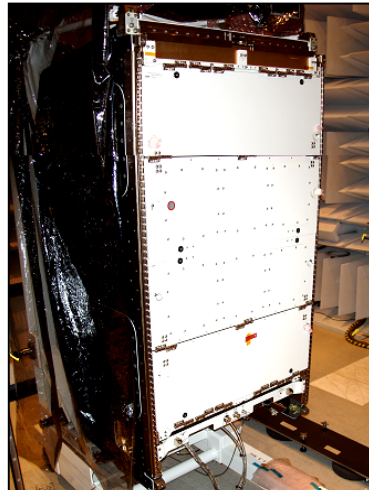
EMI Testing



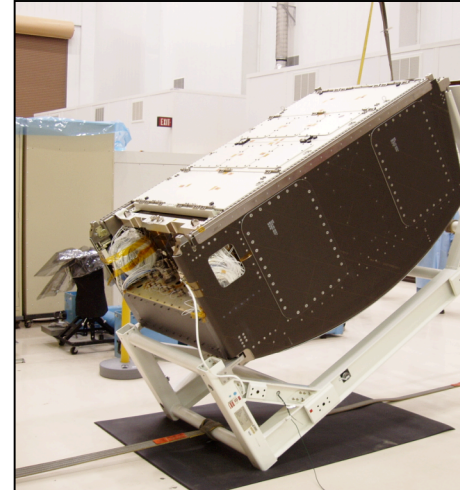
Off Gas Testing



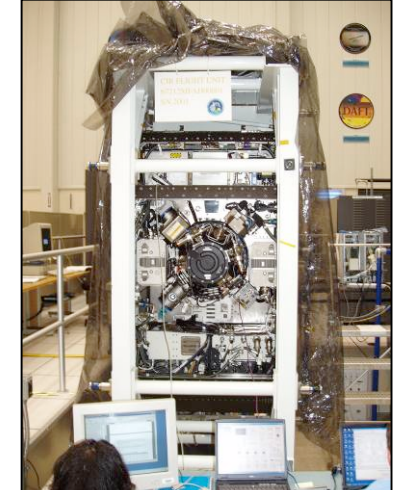
Integrated Payload Testing



Acoustic Testing



Modal Survey Testing



Mission Sequence Testing



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CIR & MDCA Initial Deployment to Power-on Readiness

